wtf: killing gametes for for more than 110 million years

Other

wtf: Killing gametes for more than 110 million years

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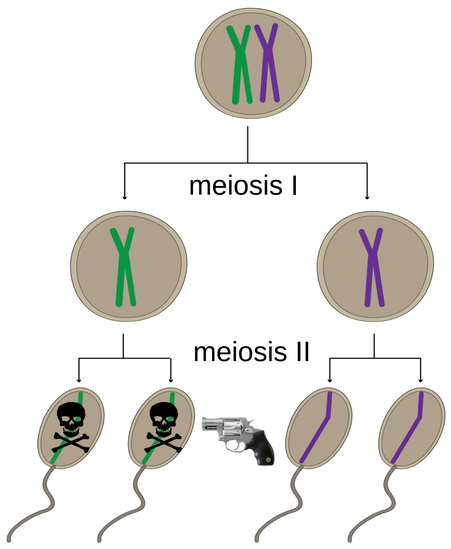
Meiotic drivers break Mendel's law of segregation



- Increase their own transmission into the next generation (up to 100%)
- Can decrease fertility
- Are found throughout eukaryotes:

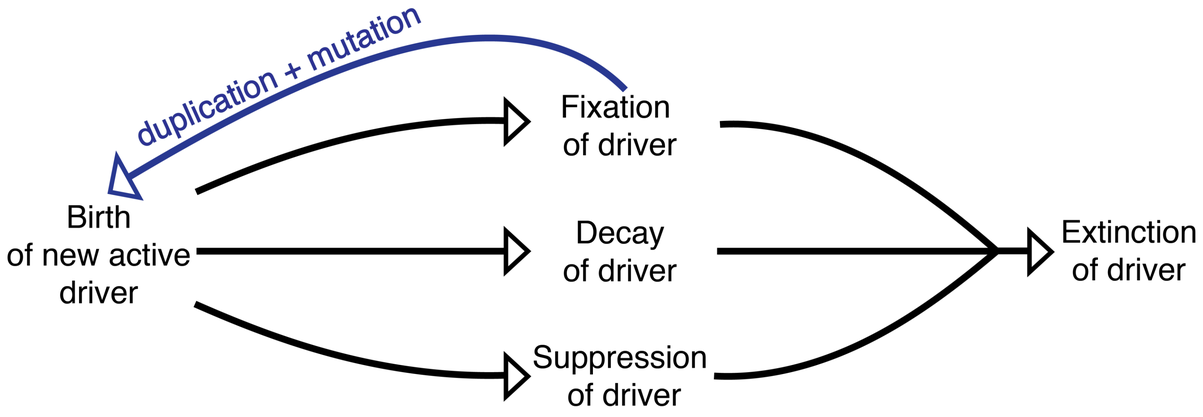
  SD in *Drosophila melanogaster*

  t-haplotype in *Mus musculus*

  Spok in *Podospora anserina*

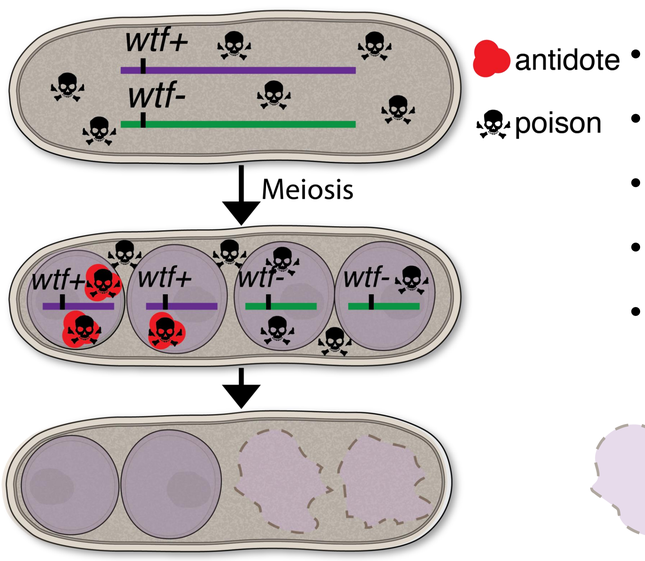
  Sa in *Oryza sativa*

Model for meiotic drive evolution



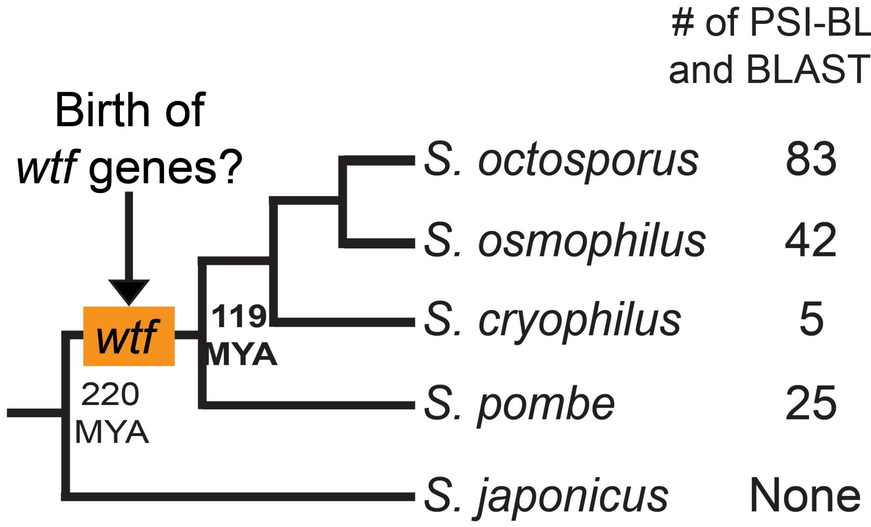
- Meiotic drivers are predicted to have a short evolutionary lifespan
- Duplication events and mutation could allow meiotic drivers to persist

wtf gene are meiotic drivers in *S. pombe*

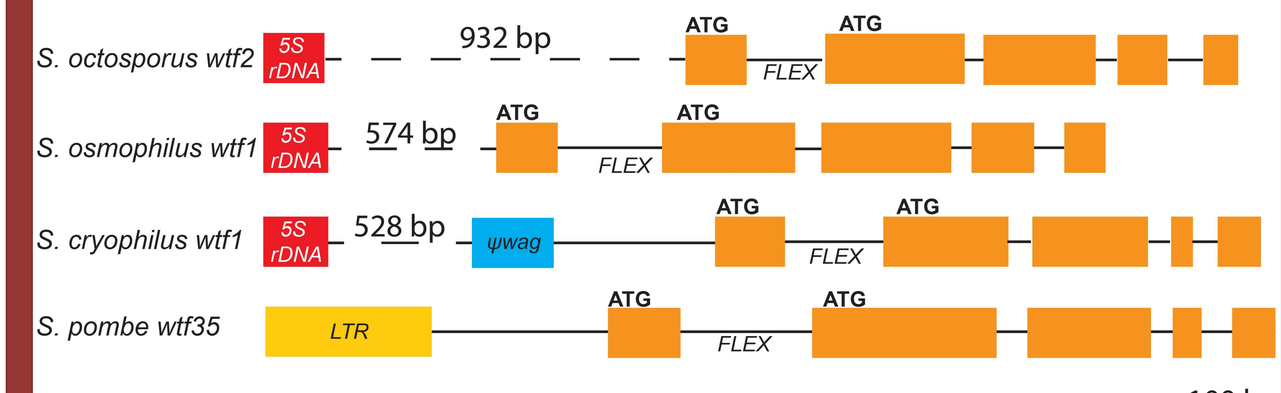


- *wtf* (*with transposon fission yeast*)
- 1 gene encodes two proteins
- poison spreads to all gametes
- antidote is gamete-specific
- drive facilitates spread of *wtf* allele in a population

Phylogenetic analysis suggests *wtf* genes are 110 million years old



S. octosporus, *S. osmophilus* and *S. cryophilus wtf* genes share features with *S. pombe* meiotic drivers



FLEX = Binding site of transcription factor Mei4 that controls poison transcription

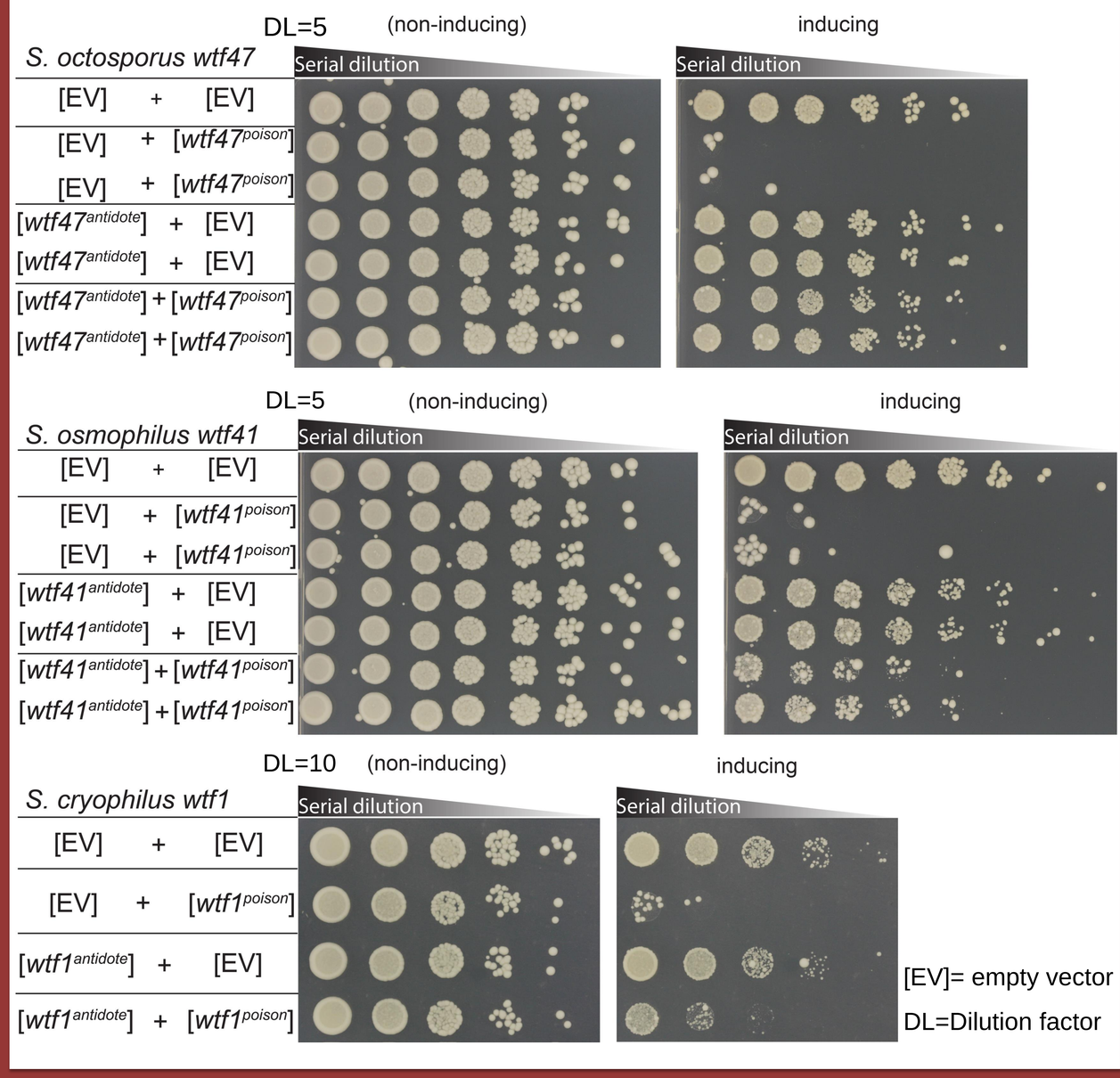
LTR dispersed repetitive sequences

5S rDNA

ψwag pseudogene *wtf associated gene*

wtf genes encodes poison and antidote proteins

Testing ability of *S. octosporus, S. osmophilus* and *S cryophilus wtf* genes to encode poison and antidote proteins by expressing them in budding yeast.



[EV]= empty vector

DL=Dilution factor

Conclusions

- *wtf* genes are present in *S. octosporus, S. osmophilus, S. cryophilus* and *S. pombe*
- *wtf* genes are associated with dispersed repetitive sequences which may allow them to duplicate in the genome by gene conversion
- *wtf* genes of the four species encode poison and antidote proteins
- *S. octosporus wtf* gene cause meiotic drive in *S. octosporus* (Li-Lin Du lab)
- *wtf* genes have been meiotic drivers for at least **110 million years**

References: Nuckolls and Bravo Núñez et al. (2017); Hu et al. (2017), Rhind et al. (2011)

Funding: NIH R00, NIH DP2, Searle Scholars Award, Stowers Institute